

the *Lepidoptera* may have been tentative, and well within the competence of ordinary variability.

The above sufficiently trite train of thought has been suggested to me by the consideration of analogous facts known to every angler. Many fishes greedily snap at anything that glistens or is highly coloured, especially if it be rapidly drawn through the water, and the slight additional disguise imparted to artificial bait of this description by a spinning motion renders it very attractive. The highly specialised salmon is easily deceived, and the most killing artificial flies for this fish make no pretence to resemble anything in nature, and are attractive in proportion to their gaudiness. The same is true of his congener the trout, although this fish appears to be somewhat more æsthetic in his tastes; and the most useful artificial flies employed to entice him are mere generalised imitations of his natural food. Indeed, on these grounds no less than on those of anatomy, it cannot be doubted that the *Teleostei*—albeit highly specialised of their kind—have failed to develop that acuteness of vision which their rapid movements would seem to render desirable, and are yet in the stage in which a very imperfect mimicry misleads them; and it is not an unreasonable presumption that birds were once in a very similar condition, from which they have emerged in consequence of the necessity for frequent and abundant supplies of food entailed upon them by their active mode of life. Under these circumstances it must have gone hard with the helpless caterpillar, so toothsome and nutritious, seeing that he could not, like the mature *Phryganide* and *Ephemeride*, keep out of harm's way by shunning the element inhabited by his natural foe; and hence arose the necessity for his protective modification. How urgent was the need for this is amply shown by the fact that several distinct modes of protection have been enlisted in his defence, viz. cuticular hypertrophy resulting in hairiness, mimicry of the vegetation on which he feeds and lives, and unpalatable flavour; to which has been superadded mimicry of the unpalatable forms by those of good flavour. But even with all this adventitious aid the struggle would probably have proved exterminating to him by reason of the voracity of birds, had not the teeming imago participated in the protective modifications, and thereby been enabled to maintain the balance of supply and demand necessary for the survival of the order.

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PAUL HENRY STOKOE

Threatened Extinction of the Elephant

THE threatened extinction of any existing species of plant or animal cannot fail to be matter of real concern to all students of science, who ought to neglect no feasible means for preventing so deplorable an occurrence.

Of the few gigantic mammals still living on the surface of our planet, none possesses more interest and none are more worthy preservation than the elephant. Yet it is an accepted conclusion that the elephant is doomed to extinction, and that within a measurable period of time this majestic quadruped will have suffered the fate of the Dodo. Cannot such a calamity be prevented? Surely the destruction of elephants might be legally controlled (in India, at any rate), and their capture (for domestication) might be limited, as it is well known they never breed in confinement. The continuous rise in the market-price of ivory, and its recent unprecedented scarcity as an article of commerce, are ominous signs, and renders it incumbent on the votaries of science to consider what may be done in the matter. It is no question of mere sentiment—it is of vital importance; and if "ancient monument, ruins, &c." are worth protecting, it cannot be denied that so remarkable and interesting a creature as our colossal Pachyderm merits some effort in his behalf.

EDWARD E. PRINCE

United College, University of St. Andrews, March 15

A Curious Case of Ignition

ONE fine morning recently, as two ladies were standing together in the drawing-room of a house in this neighbourhood, smoke was observed to rise from the dress of one of them. This was found to be due to ignition by the solar rays focused on her dress by the lens of a graphoscope which stood on the table. Similar cases of accidental concentration of the sun's rays have, I am aware, been recorded. It would be interesting to know whether any serious fires have thus originated. One can easily imagine circumstances which would favour such results from a simple cause.

Finchley, March 26

M.

SINGING, SPEAKING, AND STAMMERING¹

I.—SINGING

THE voice, essentially a musical instrument, has only of late been scientifically considered. Even now singing is too much dealt with as an art, and its acquirement as an accomplishment. The professional mystery with which it is surrounded serves no good purpose, and favours empiricism. At ladies' schools the old fiction of what are quaintly termed "finishing lessons" still survives; they often succeed in finishing any prospects the pupil may have had of becoming a singer. Most of the current primers and tutors are ludicrously vague and feeble, many methods are absolutely injurious to the voice; for the improvement of which one ingenious inventor has suggested the use of a false palate, and another the fitting of singers' mouths with a sort of bell-shaped snout or proboscis to act as a resonator. A chorus of such proboscidiens on the Handel orchestra would be an appalling sight. The real foundation of our knowledge rests on the researches of Helmholtz on the physical, and of Garcia on the physiological, side. The classical discoveries of the former as to the production of vowel-sounds by the superaddition of a varying harmonic in the mouth-cavity, and of the latter by the examination of the larynx in action by means of a mirror, brought before the Royal Society in May, 1855, have formed the substratum of much which has now become the common property of scientific men. Dr. Bristowe, in his Lumleian lectures of 1879, has added some pathological data of considerable value, and Dr. Walshe, in his "Dramatic Singing, Physiologically Estimated," has touched on points connected with the sympathetic and emotional power which this most perfect of instruments can be made to exercise. It owes this in a great measure to the fact that it can combine musical sounds with significant words, and thus interest at once the ear and the intelligence. After a demonstration of the action of the larynx and fauces in phonation, illustrated by some excellent photographs taken from his own larynx by Mr. Emil Behnke, and thrown on the screen, vowel-sounds were shown to be thirteen in number in the English language, with six more in French and German, fifteen of these being oral in origin, and four, all French sounds, nasal. Consonants were about sixteen in number, and had been called "noises" by Max Müller, owing to their comparatively unmusical character. They are chiefly caused by some check or obstruction to the laryngeal note. A diagram of Madame Seiler's was, however, shown which indicates that there is an oral resonance-note even for consonants, though it is much more obscure and uncertain than that of the vowels. Melville Bell's division of vocal sounds into vowels, consonants, and glides or semivowels was adverted to, and his ingenious device of visible speech briefly explained, but left for fuller consideration in the second lecture. The contrast was then pointed out between singing, in which the musical notes predominate and are separate or discrete; intoning, which is speech intentionally rendered monotonous for better transmission in large spaces like cathedrals; recitative, which is the converse of the former, being singing partially loosened from the trammels of time, rhythm, and melody, so as to approximate to speaking; speech itself, which uses continuous inflection; declaiming, which is speech with the addition of a histrionic and emotional element; reading, which is a faint and as it were distant reproduction of speaking in a lower key, quieter and less marked in accent than in speaking *viva voce*; and whispering, which is purely oral, without a laryngeal ground note, and which may be termed voiceless speech.

The different qualities, compass, and register of voices

¹ Abstract by the Author of three Lectures at the Royal Institution, by W. H. Stone, M.D.F.R.C.P.

were then described. The larynx of the child, like its head, is large relatively to the rest of the body. At the age of fourteen or fifteen, rather earlier in girls than in boys, the vocal apparatus enlarges and strengthens. In boys the vocal chords about double in length; in girls they increase from five to seven. In the latter case the pitch of the voice is not materially altered; in the male it usually descends an octave or more.

Garcia adopted the division of Registers into three, namely, the chest, falsetto, and head voice, due originally to Müller. This remains the most practical mode of classification, though the word falsetto is misleading, being liable to confusion with the artificial male voice bearing the same name, and may well be replaced by the phrase Medium. The term register has been enveloped in much professional mystery, and has been far too much refined upon. There has also been a confusion of octaves, from which even Madame Seiler is not free, due mainly to the modern and objectionable method of scoring music for the tenor voice in the soprano clef, and an octave too high. Register evidently marks an alteration of mechanism in the voice-reed and resonator to enable it to obtain the very remarkable compass, amounting to nearly five octaves, of which the human voice is possessed. Single voices run to three octaves or more. Catalani had $3\frac{1}{2}$; Bastardella, heard by Mozart in 1770, had the same. Madame Carlotta Patti can reach G \sharp in alt. Bennati, a tenor, had three full octaves, and Tamberlik reached the C \sharp of 544 double vibrations.

The words Head and Chest obviously only represent subjective sensations which accompany the shifted mechanism. In many parts of the voice similar notes can be reached in two registers, but with different force and quality, on either side of the break.

In using chest-voice the vibration can be seen to involve the whole vocal chord and the arytenoid cartilages. At about A in the male and C in the female the chords act alone, though the first mechanism can by an effort be continued. The second form of vibration takes the voice up to F, the usual limit of bass voices and of the chest register. Above the F the chords are stated to lengthen, giving by a second elongation the second series of the chest register, which forms the bulk of the tenor compass, the remainder being formed by a variable number of falsetto notes. These seem to be produced by a thinning of the edges of the chords. Czermak lighted the larynx of thin persons strongly from the outside, and found that sufficient light was transmitted to show a decided increase of transparency in the chords at this point. All observers agree in placing this change, both in males and females, between F and F \sharp . In this region, common to both males and females, an amusing experiment can be made by causing a tenor male and a contralto female singer to execute the same passage behind a screen, or in an adjoining room. It is difficult, and at times impossible, to discover the sex of the singer from the quality of the tone. There still remains among male voices the curious and only partially explained counter-tenor. Sometimes by arrest of development or by accident the boy's compass is retained in after-life. This accident may be quite independent of masculinity, as those who have heard lusty, rubicund Yorkshiresmen, with their wives and children round them, troling out a sweet treble in glees on the terraces of the Crystal Palace after the Handel Festival, can testify. But besides this rare accident, most basses and baritones can cultivate an artificial and peculiar voice which most properly bears the name falsetto. Its production appears to be in great measure a matter of education. It was seemingly commoner in the madrigalian epoch and in the time of Queen Elizabeth than it is now. Dr. Bristowe says truly that the mechanism of its production is still doubtful, though many attempts have been made to determine it. Such voices are not only artificial, but complex and uneven, being a

compound of high chest notes and others of special quality. There is a serious break between the two both in production and in quality, which practised singers disguise by running the one into the other at different places, according as the passage to be sung ascends or descends.

It will have been seen that female voices overlap the compass of the male voice by an octave or more. Many contraltos take the E on the bass stave, which is well in the middle of the bass voice, and a low note for a tenor singer. Hence we sometimes hear of female tenors, though the effect is usually more peculiar than pleasing. Our great English contralto, Madame Patey, however, drops to this note with fine effect in Handel's oratorio of Solomon, which was written for the exceptional and now fortunately obsolete voice of Farinelli.

In females the break is somewhat higher than in males, but the transition to the falsetto takes place at the same note G. The contralto does not use the head-register.

This, otherwise called the Small, begins as just stated. Its upper limit varies, the extremes having been already given. Mozart wrote the fine air *Gli Angui d'Inferno* in the "Magic Flute" for such an exceptional voice reaching to F in alt. A commoner and perhaps pleasanter limit is the C below this.

All authorities agree in describing a curious appearance of the glottis in singing these notes. This is a folding together of its posterior half with vigorous vibration of its anterior part. Such an appearance can only be produced either by some stopping of the chords at the middle by contact with structures lower down, or by overlapping from vigorous approximation of the arytenoid cartilages. The former supposition lacks anatomical confirmation, and the latter, which is anatomically possible, has the implied, though not the expressed sanction, of Helmholtz. The drawing of this appearance is given by Madame Seiler, who alone of laryngoscopists, possesses a register peculiar to the female.

Dr. Stone was materially assisted in his first lecture not only by Mr. Behnke, but also by his colleague Dr. Felix Semon, who gave admirable demonstrations of the healthy larynx, as seen in Mr. Williams, and some other pupils of St. Thomas's Hospital.

ACCLIMATISATION OF EDIBLE MOLLUSKS

A RECENT and interesting notice by Mr. F. P. Marrat of Liverpool, who is an excellent conchologist, mentions the introduction into the Cheshire coast of what he calls the "wampum clam," or *Venus mercenaria* of Linné; and he concludes that there is "a fair prospect of the naturalisation, on the extensive shallow shores of Lancashire and Cheshire, of an extremely nutritious and highly esteemed food-product, new to Great Britain." The late Prof. Gould says that this mollusk is known in Massachusetts under the name of "Quahog," given to it by the Indians. According to him and other American writers on the subject, the true "clam" *par excellence* is *Mya arenaria* of Linné. I was present as a guest at one of the fashionable "clam-feasts"; but the muddy flavour derived from the habitat of that mollusk does not agreeably commend itself to my palatable recollection. However, *chacun à son goût!* *Mya arenaria* inhabits the western coasts of the North Pacific as well as both sides of the North Atlantic.

The American oyster (*Ostrea virginica* of Gmelin = *O. borealis* and *O. canadensis* of Lamarck) is peculiar to North America, and has now found its way into the London market. It differs from the common European oyster (*O. edulis*, L.), and is equally variable as regards size. *O. virginica* has been within the last few years introduced into the mouth of the Tagus, and is called the Portuguese oyster. Our own or "native" oyster was